

WHAT IS CLAIMED IS:

1. A silicon-based film comprising a crystal phase formed on a substrate with a surface shape represented by a function f , wherein the silicon-based film is formed on a substrate with a surface shape having a standard deviation of an inclination $\arctan(df/dx)$ from 15° to 55° within the range of a sampling length dx from 20 nm to 100 nm, a Raman scattering strength resulting from an amorphous component in the silicon-based film is not more than a Raman scattering strength resulting from a crystalline component, and a difference between a spacing in a direction parallel to a principal surface of the substrate and a spacing of single crystal silicon is within the range of 0.2% to 1.0% with regard to the spacing of the single crystal silicon.

2. The silicon-based film according to claim 1, comprising a crystal of a columnar structure in a thickness direction.

3. The silicon-based film according to claim 1, wherein a percentage of a diffraction strength of (220) plane due to X-ray or electron beam diffraction is 30% or more of a total diffraction strength.

4. The silicon-based film according to claim 1, which is formed by a plasma CVD method using a high frequency.

5 5. The silicon-based film according to claim 4, wherein the high frequency is not less than 10 MHz but no more than 10 GHz.

10 6. A photovoltaic element comprising a silicon-based semiconductor layer having at least one pin junction on a support, wherein at least one i-type semiconductor layer comprises the silicon-based film as set forth in any one of claims 1 to 5.

15 7. The photovoltaic element according to claim 6, wherein the silicon-based semiconductor layer is formed on a substrate comprising at least a first transparent conductive layer stacked on the support, and the first transparent conductive layer has the surface shape
20 represented by the function f.

8. The photovoltaic element according to claim 6, wherein the support is a conductive support.